

DESCRIPTION

TITLE OF THE INVENTION

Methods of Designing Optimal PID Controllers

TECHNICAL FIELD OF THE INVENTION

This invention relates to the design of the structure of a multivariable PID controller and the optimal choice of its PID parameters.

BACKGROUND OF THE INVENTION

A traditional PID controller is used to control an industrial process. The process variable (PV) goes into the PID controller, which calculates the controller output (CO) according to a PID control equation. This CO is then converted to an analog signal, which is sent to the process so that the said PV can track a user specified value called set point (SP). The said SP can change with time. The performance of a PID controller depends on the choice of its three PID parameters. For independent form of PID controllers these three PID parameters are the proportional gain K_p , the integral gain K_i , and the derivative gain K_d . For dependent form of PID controllers these three PID parameters are the gain K , integral time T_i , and derivative time T_d . In traditional PID controllers the said PV, SP, CO, and PID parameters are all scalars. We call this kind of PID controllers the single-input single-output (SISO) PID controllers. The Ziegler-Nichols PID controller tuning method is the major one of the many methods for finding the values of PID parameters.

DETAILED DESCRIPTION OF THE INVENTION

In this invention the SISO PID controller is extended to the multiple-input multiple-output (MIMO) PID controller that has n process variables $PV_1, PV_2, \dots, \text{and } PV_n$ and m controller outputs $CO_1, CO_2, \dots, \text{and } CO_m$, where m and n are positive integers. Corresponding to $PV_1, PV_2, \dots, \text{and } PV_n$ there are n set points $SP_1, SP_2, \dots, \text{and } SP_n$. In this case PV becomes a vector with $PV_1, PV_2, \dots, \text{and } PV_n$ being its first, second, \dots , and n -th component, CO becomes a vector with $CO_1, CO_2, \dots, \text{and } CO_m$ being its first, second, \dots , and m -th component, SP becomes a vector with $SP_1, SP_2, \dots, \text{and } SP_n$ being its first, second, \dots , and n -th component, and the PID

PID controllers with their parameters so obtained guarantee that PV can track SP quickly.